PATENT SPECIFICATION 982,153

DRAWINGS ATTACHED.

982,153

Date of Application and filing Complete Specification:
Feb. 23, 1962. *No. 7176/62.*

Application made in United States of America (No. 91742) on Feb. 27, 1961.

Complete Specification Published: Feb. 3, 1965.

Index at Acceptance:—C1 M(2D9, 3A, 3D17, D10, S16, S18).

Int. Cl.:—C 03 b.

COMPLETE SPECIFICATION.

Downflow Glass Sheet Drawing Method and Apparatus.

We, CORNING GLASS WORKS, a Corporation organized under the laws of the State of New York, United States of America, of Corning, New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a downflow glass sheet drawing method and apparatus involving the flow of streams of molten glass down the converging sides of a sheet forming member, which streams join to form a single sheet as they leave the member.

Many systems have heretofore been suggested, for example to produce sheet glass, involving the introduction of molten glass into a trough of a member having two opposite downwardly converging side walls, feeding molten glass to the trough while molten glass overflows or spills from the trough side walls and flows in thin sheet-like streams down such walls. These streams merge with one another adjacent the lines of juncture of such side walls and form a single sheet drawn downwardly by the weight of the pendant glass, assisted by any suitable form of drawing mechanism.

In all of such systems known to the applicants, the molten glass is directly supplied to the trough in one or more streams introduced into the trough either from above it or through its ends. In such arrangements uniformity in the height and width of the walls where the glass overflows is very critical and such a trough can only deliver streams of glass of uniform thickness providing glass enters the trough in such a manner that it is available in like volume along its entire length.

When glass is introduced into the trough ends a greater overflow is likely to occur from glass surging upwards near its ends than in the central space therebetween, thus contributing to providing a sheet which is thinner in the central than in the lateral regions. Moreover when the slot bordering walls of the trough comprises also the metering passage for glass introduced thereinto, since when glass is fed to the trough ends, the rate of glass flow thereover for any given head of glass will vary as a result of any significant dimensional change in slot width; and since under these circumstances the slot bordering walls are subjected to pressures in direct relation to the height of the glass head, they are particularly vulnerable to dimensional change. If on the other hand a stream or ribbon of glass is fed to the trough from above it, the stream overflowing the trough will vary in thickness as the transverse thickness of the fed stream varies. Also, when such a stream enters the top of the pool of glass within the trough there is the danger of the stream interfering with the desirably undisturbed flow of glass from the top of the pool over the trough side walls.

The present invention provides a method of making glass sheet comprising flowing molten glass into one end of a horizontally confined longitudinal space, issuing the molten material upwardly from the space in a row of streams to form a longitudinal pool of molten material, flowing the material downwardly from the upper surface of the pool over two oppositely disposed downwardly converging surfaces longitudinally of the space to a common line of juncture and then drawing away in sheet form the material which flows down over the converging surfaces. Supply of molten glass to the reservoir, and thence to the trough via such passages, is from a head of glass having

[*Price 4s. 6d.*]

access to the reservoir at one end thereof. Such glass is supplied under a sufficient head to insure that a desired volume of glass issues from each of the respective passages to keep the trough supplied with a desired volume of glass in the respective regions along its length and without disturbing the streams of glass overflowing the trough. With this construction, substantially all of the resistance to flow is borne by the network of wall structure bordering the metering passages, thus avoiding the building up of pressures between the trough side walls that would tend to warp them in directions to widen the gap therebetween. Thus, by feeding the trough via a row of metering passages, the primary cause of warping of the trough walls is avoided and such warping as does occur does not materially change the volume of glass flow therefrom.

As will be understood the cross sectional shape and arrangement of the metering passages are a matter of choice. For example, the passages may simply comprise circular apertures. Alternatively, the apertures may be non-circular and so arranged that streams issuing therefrom have a greater portion of their borders in close proximity with one another as they enter the trough, than possible when circular apertures are provided, to further insure full blending of the streams within the trough.

Also, as will be well understood, the cross sectional dimensions of the metering passages or apertures is a matter of choice and depends upon the character of sheet desired. For example, if a flat sheet is to be produced that is transversely uniform in thickness, the dimensions of the passages in the end regions of the trough may differ in a graduated manner from those in the mid region thereof to meter the flow in a manner to compensate for the greater heat loss in the lateral regions of the sheet than in the mid regions thereof.

On the other hand, or additionally, if it is desired to produce a sheet varying in thickness, or having a wavy pattern for example, each alternate passage may sufficiently differ in size from the adjacent passage that with a sufficient head of glass transversely undulating streams of glass would flow over the trough side walls to impart the desired varied characteristics to the sheet produced.

In the accompanying drawings: —

Fig. 1 is a side elevational view, partly in section, of a sheet forming apparatus embodying the invention.

Fig. 2 is a view taken on lines 2—2 of Fig. 1.

Fig. 3 is an enlarged perspective view of a fragment of the form of feeder member shown in Figs. 1 and 2.

Fig. 4 is a top plan view of a fragment of an alternative form of feeder member embodying the invention.

Referring to the drawing in detail, a feeding member is provided having end walls 10 and 11 and two oppositely disposed converging side walls such as 12 having embodied in its top a trough 13 over the two opposite side walls of which glass can be caused to flow from the trough. The feeding member has embodied within it a tubular reservoir 15 in communication with the trough 13 via circular apertures or passages 16 arranged in a row in the region of the top wall of the feeding member comprising the bottom wall of the trough 13.

The feeding member is suitably supported within a muffle 21 and at the end 11 the reservoir 15 is arranged in communication with a chamber 22 into which molten glass, from a suitable melting tank, is supplied through a channel 23.

Under some circumstances, as when the glass is below a given viscosity, the provision of a row of circular apertures may prevent full homogeneity of the glass of adjacent streams within the trough. Under these circumstances it may be desirable to provide passages between the reservoir and the trough which bring the roots of the adjacent streams issuing from the reservoir in laterally overlapping relation. A row of triangular passages 30 as illustrated in Fig. 4 ideally serves to bring the streams in overlapping relation with one another at their roots to obtain better homogeneity of the glass wholly within the trough 35 of a feeding member 36.

As will be understood the possible alternatives to the two aperture arrangements shown are practically unlimited.

In operation, molten glass 31 enters chamber 22 from channel 23 and fills up the reservoir 15. Because of the head of glass provided, the glass wells up into trough 13 and then flows down the side walls, such as 12, to be united at the lower edge thereof into a single sheet 33.

WHAT WE CLAIM IS: —

1. A method of making glass sheet, comprising flowing molten glass into one end of a horizontally confined longitudinal space, issuing the molten material upwardly from such space in a row of streams to form a longitudinal pool of molten material, flowing the material downwardly from the upper surface of the pool over two oppositely disposed downwardly converging surfaces longitudinally of such space to a common line of juncture and then drawing away in sheet form the material which flows down over the converging surfaces.

2. A method as claimed in Claim 1 which includes flowing the molten material into such space under a substantial head to

attain a substantially uniform pressure along the entire length of the reservoir whereby the head of all streams issuing therefrom is substantially the same.

3. A method as claimed in Claim 1 which includes issuing the streams into the pool from regions laterally overlapping one another along such space.

4. A method as claimed in Claim 1 which includes metering the flow of the various streams to produce desired transverse characteristics in the sheet.

5. A method of making glass sheet material substantially as herein described with reference to the accompanying drawings.

6. An apparatus for producing glass sheet comprising a sheet forming member having a horizontally disposed molten glass supply reservoir, the said member having an overflow trough embodied therein arranged above its reservoir of a length corresponding to the width of sheet to be initially produced with passages through its bottom in communication with the reservoir and means for supplying a head of molten glass to such reservoir via one end thereof to fill it and to fill the trough via such passages, whereby the molten glass overflows down about the outside of said member, unites at the lower edge thereof and flows off as a single sheet.

7. An apparatus for producing glass sheet from a molten supply body thereof, comprising a member from which molten glass flows in a sheet forming process, the said member having a molten glass receiving reservoir with an entrance passage at one end and exit passages along its length through its top into a trough over the sides of which molten glass flows in such process.

8. An apparatus as claimed in Claim 7 wherein the passages are non-circular in cross section.

9. An apparatus as claimed in Claim 8 wherein the passages are triangular in cross section.

10. An apparatus for producing glass sheet, comprising a member having two oppositely disposed downwardly converging side walls terminating along a common line along their bottoms and at their top edges terminating as bordering walls of a molten glass supply trough embodied in the top of such member, a reservoir in communication with such supply trough via passages through the member arranged in a row lengthwise of the trough, and means for supplying a head of molten glass to said reservoir to fill it and thence the trough via such passages, whereby molten glass overflows the side walls, joins at the common line along their bottom edges, and flows therefrom as a single sheet.

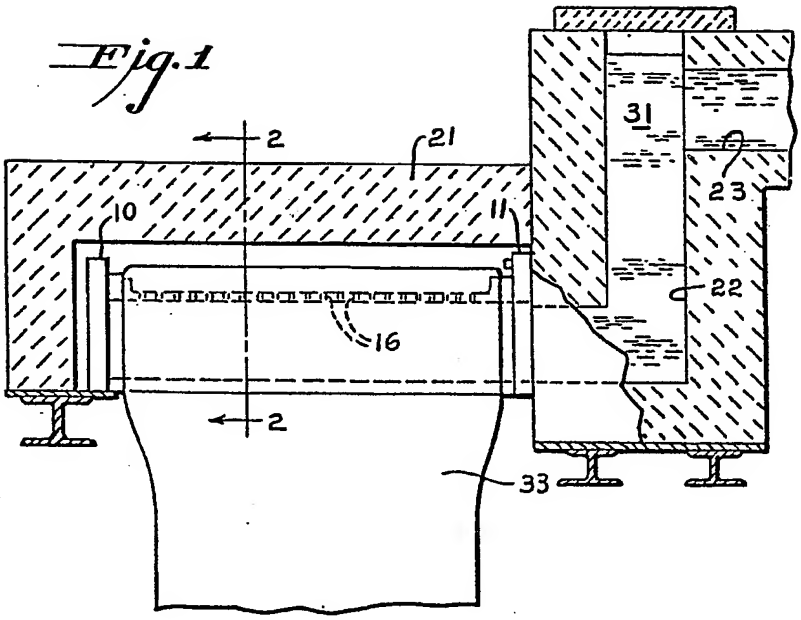
11. An apparatus for producing glass sheet substantially as herein described with reference to the accompanying drawings.

ELKINGTON & FIFE,
Chartered Patent Agents,
Bank Chambers,
329 High Holborn,
London, W.C.1.
Agents for the Applicants.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1965.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

982153 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1



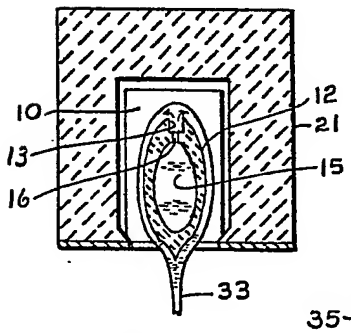


Fig. 2

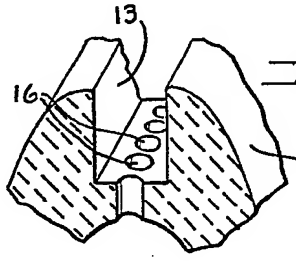


Fig. 3

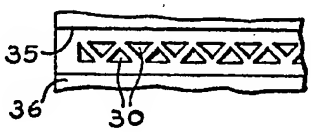


Fig. 4